PART III. Financial Impacts.

This part summarizes the financial costs as reported by airport authorities to upgrade or build infrastructure to safely accommodate NLA. As previously stated in section 3 of Part I, the survey consisted of five separate areas deemed the most significant to be impacted by NLA service. Two of the five areas dealt with the runway environment. Hence, four separate sections follow.

1. Runway Environment.

This section covers the estimated costs to upgrade primary runways, crosswind runways, and to construct new ADG VI runways with parallel taxiways. Reported costs are attributed to runway widths, shoulder widths, blast pad width, entrance taxiway fillets, and the category "Other Costs." Items under the category "Other Costs" include new or relocation of signs, lights, electrical systems, new drainage, etc. Reported costs for parallel taxiways supporting new ADG VI runways are found in section 2. Attachment 3 provides cost breakdowns by design features and total estimated costs by individual airports.

a. **Tables 2 and 3.** Tables 2 and 3 show the total estimated cost for all airports as a group and for individual airports. Furthermore, the tables present the same information alphabetically and by rank order. The ranking associated with each airport is based on the May 1997 OAG commercial service operations handled by the airport. It is worth noting that, rankings fluctuate from year to year. For example, tabulations from the May 1996 OAG placed ORD in 4th place as compared to 6th for the following year.

(1) For the category "Primary Runways," the average estimated costs for upgrades is slightly less than $10 million per airport. In terms of the highest percentages of the total estimated cost, BOS, JFK, and MEM reported 14 percent, 10 percent, and 10 percent respectively.

(2) For the category "Crosswind Runways," two-thirds of the reporting airports declared the need to upgrade both the primary and crosswind runways. DEN and DFW reported only upgrade costs to their crosswind runways. The average estimated costs for all upgrades with one exception is slightly less than $10 million per airport. ORD reported upgrade costs of $57.5 million or 35 percent of all such costs. In comparison, the succeeding highest percentages reported were BOS at 13 percent followed by JFK at 5 percent.

(3) For the category "New ADG VI Runway," tables show that LAX, ranked #1, reported this as its only alternative to accommodate NLA service. As a monetary comparison, the LAX alternative is approximately 52 percent of the total estimated cost for upgrading all of the other primary runways. In similar fashion, SFO, ranked #4, reported basically two alternatives, one being to build a new DG VI runway at an estimated cost of $2.7 billion. Only two other airports, JKF and STL, reported costs under this alternative.

(4) For airports accommodating significant cargo service, ANC and MEM reported the need to upgrade both primary and crosswind runways at a total combined cost of $42.6 million.

Table 2. Estimated Costs by Alphabetical Order.

IDENTIFIER	RANK	PRIMARY RUNWAY	CROSSWIND RUNWAY	NEW ADG VI RUNWAY
ANC	11	$8,300,000.00	$8,600,000.00	
ATL	16	$10,100,000.00	$7,300,000.00	
BDL	22	$1,300,000.00	$7,500,000.00	
BOS	9	$25,000,000.00	$21,000,000.00	
DEN	19	$0.00	$12,700,000.00	
DFW	18	$0.00	$3,834,200.00	
DTW	8	$2,052,890.00		
HNL	3			
IAD	6	$11,400,000.00	$10,400,000.00	
IAH	17	$7,500,000.00	$5,500,000.00	$0.00
JFK	2	$18,300,000.00	$14,300,000.00	$10,600,000.00
LAX	1			$95,857,000.00
MCO	13			
MEM	20	$15,200,000.00	$10,500,000.00	
MIA	5	$6,350,000.00	$6,000,000.00	
MSP	10	$440,000.00		
ORD	7	$15,000,000.00	$57,500,000.00	
PHL	14	$4,700,000.00		
PHX	21	$9,400,000.00		
SEA	12	$12,700,000.00		
SFO	4	$10,000,000.00		$2,760,000,000.00
STL	15	$6,600,000.00		$576,000,000.00
TOTAL:		**$164,342,890.00**	**$165,134,200.00**	**$3,442,457,000.00**

Table 3. Estimated Costs by Rank Order.

IDENTIFIER	RANK	PRIMARY RUNWAY	CROSSWIND RUNWAY	NEW ADG VI RUNWAY
LAX	1			$95,857,000.00
JFK	2	$18,300,000.00	$14,300,000.00	$10,600,000.00
HNL	3			
SFO	4	$10,000,000.00		$2,760,000,000.00
MIA	5	$6,350,000.00	$6,000,000.00	
IAD	6	$11,400,000.00	$10,400,000.00	
ORD	7	$15,000,000.00	$57,500,000.00	
DTW	8	$2,052,890.00		
BOS	9	$25,000,000.00	$21,000,000.00	
MSP	10	$440,000.00		
ANC	11	$8,300,000.00	$8,600,000.00	
SEA	12	$12,700,000.00		
MCO	13			
PHL	14	$4,700,000.00		
STL	15	$6,600,000.00		$576,000,000.00
ATL	16	$10,100,000.00	$7,300,000.00	
IAH	17	$7,500,000.00	$5,500,000.00	$0.00
DFW	18	$0.00	$3,834,200.00	
DEN	19	$0.00	$12,700,000.00	
MEM	20	$15,200,000.00	$10,500,000.00	
PHX	21	$9,400,000.00		
BDL	22	$1,300,000.00	$7,500,000.00	
TOTAL:		**$164,342,890.00**	**$165,134,200.00**	**$3,442,457,000.00**

(5) For the category "Other Costs," the average estimated cost was $12 million per airport. The items with the highest contribution were associated with electrical systems and new or relocation of signs and lights. Reported costs were ORD at $3.5 million and SEA at $7.6 million. JFK and BOS reported the highest percentage.

b. Table 4. Table 4 shows estimated cost for the runway categories of Primary Runway, Crosswind Runway, and New ADG VI Runway.

(1) For the categories "Primary Runway" and "Crosswind Runway," upgrades to runway width and shoulders represented the bulk of the estimated costs, i.e., 75 percent and 78 percent respectively.

(2) For the category "New ADG VI Runway," SFO and STL skew the dollar figures due to their reported costs.

Table 4. Estimated Costs for Design Features by Runway Types.

Primary Runway

DESIGN FEATURE	Count	Sum	Average
Blast Pads	11	$6,872,890.00	$624,808.18
Other Costs	18	$40,420,000.00	$2,245,555.56
Shoulders	18	$59,850,000.00	$3,325,000.00
Width	11	$77,200,000.00	$7,018,181.82
TOTAL:	**58**	**$184,342,890.00**	

Crosswind Runway

DESIGN FEATURE	Count	Sum	Average
Blast Pads	5	$10,100,000.00	$2,020,000.00
Other Costs	14	$25,069,200.00	$1,790,657.14
Shoulders	10	$33,665,000.00	$3,366,500.00
Width	9	$96,300,000.00	$10,700,000.00
TOTAL:	**38**	**$165,134,200.00**	

New ADG VI Runway

DESIGN FEATURE	Count	Sum	Average
Blast Pads	1	$2,000,000.00	$2,000,000.00
Other Costs	6	$2,758,982,000.00	$459,830,333.33
Shoulders	2	$10,400,000.00	$5,200,000.00
Width	3	$671,075,000.00	$223,691,666.67
TOTAL:	12	$3,442,457,000.00	

2. Taxiway Environment.

This section covers the estimated costs to upgrade or build new DG VI taxiways and to widen the taxiway safety area. For this topic, the survey was written to separate the costs associated with taxiway intersections (fillets) from straight portions of the taxiway system. The division provides a means to priorities airfield construction. Reported costs are attributed to widening existing taxiway widths, shoulders, fillets, and safety areas, relocation/installation of lights and signs, etc. Attachment 4 provides cost breakdowns by design features and total estimated costs by individual airports.

a. **Tables 5 and 6**. Tables 5 and 6 show the total estimated cost for all airports as a whole and for individual airports. Furthermore, the tables present the same information alphabetically and by rank order. Six airports reported dual costs to upgrade the existing taxiway and to build a new ADG VI taxiway. Of those six, SFO reported the largest percent of all such costs, i.e., 20 percent. In terms of only upgrading existing taxiways, ORD reported the largest costs at $94.5 million. The average cost to upgrade an existing taxiway system is $22.5 million. The average cost to build a new ADG VI taxiway system is $28.7 million.

b. **Table 7**. Table 7 reports cost breakdowns by design feature. Three design features generated the majority of all costs. In terms of percentages, widening paved sections records 32 percent followed by widening shoulder widths 29 percent and fillets at 24 percent or a total of 85 percent.

c. **Table 8**. Table 8 shows that the bulk of all reported cost was attributed to the straight portions of the airfield taxiway system, i.e., 75 percent. The percentage, however, excludes the costs, 28%, attributed to parallel taxiways that support the runway. Those costs deal with providing an adequate centerline separation between the two so that the OFZ airspace is not violated. The remaining 4 percent are attributed to the intersecting taxiways and the category “Other.”

Table 5. Estimated Costs by Alphabetical Order.

IDENTIFIER	RANK	UPGRADE EXISTING TAXIWAY	NEW ADG VI TAXIWAY
ANC	11	$18,800,000.00	
ATL	16	$1,300,000.00	
BDL	22	$12,750,000.00	$29,850,000.00
BOS	9	$12,500,000.00	
DEN	19	$22,300,000.00	
DFW	18		
DTW	8	$6,320,000.00	
IAH	17	$10,200,000.00	$2,600,000.00
IAD	6	$17,500,000.00	
JFK	2	$62,200,000.00	
LAX	1		$43,333,000.00
MEM	20	$12,600,000.00	$4,200,000.00
MIA	5	$51,370,000.00	
MSP	10	$2,700,000.00	
ORD	7	$94,500,000.00	
PHL	14	$2,500,000.00	
PHX	21	$16,600,000.00	
SEA	12	$6,600,000.00	$42,000,000.00
SFO1	4	$19,700,000.00	
SFO2	4	$43,300,000.00	
SFO3	4	$59,200,000.00	$63,300,000.00
STL	15	$11,600,000.00	$576,000,000.00
TOTAL:		**$484,540,000.00**	**$761,283,000.00**

Table 6. Estimated Costs by Rank Order.

IDENTIFIER	RANK	UPGRADE EXISTING TAXIWAY	NEW ADG VI TAXIWAY
LAX	1		$43,333,000.00
JFK	2	$62,200,000.00	
SFO1	4	$19,700,000.00	
SFO2	4	$43,300,000.00	
SFO3	4	$59,200,000.00	$63,300,000.00
MIA	5	$51,370,000.00	
IAD	6	$17,500,000.00	
ORD	7	$94,500,000.00	
DTW	8	$6,320,000.00	
BOS	9	$12,500,000.00	
MSP	10	$2,700,000.00	
ANC	11	$18,800,000.00	
SEA	12	$6,600,000.00	$42,000,000.00
PHL	14	$2,500,000.00	
STL	15	$11,600,000.00	$576,000,000.00
ATL	16	$1,300,000.00	
HIA	17	$10,200,000.00	$2,600,000.00
DFW	18		
DEN	19	$22,300,000.00	
MEM	20	$12,600,000.00	$4,200,000.00
PHX	21	$16,600,000.00	
BDL	22	$12,750,000.00	$29,850,000.00
TOTAL:		**$484,540,000.00**	**$761,283,000.00**

Table 7. Estimated Costs by Design Features.

DESIGN FEATURE	UPGRADE EXISTING TAXIWAY	NEW ADG VI TAXIWAY
Fillets	$138,000,000.00	$580,300,000.00
Light & Signs (fillet sections)	$33,200,000.00	$3,750,000.00
Lights & Signs (straight sections)	$35,220,000.00	$1,000,000.00
Other	$1,000,000.00	$45,658,000.00
Paved Width	$139,500,000.00	$111,875,000.00
Shoulder Width	$128,020,000.00	$16,800,000.00
Taxiway Object Free Area	$3,000,000.00	$1,500,000.00
Taxiway Safety Area	$6,600,000.00	$400,000.00
TOTAL:	**$484,540,000.00**	**$761,283,000.00**

Table 8. Estimated Costs by Intersecting, Straight and Combination Runway/Parallel Taxiway.

DESIGN FEATURE	UPGRADE EXISTING TAXIWAY	NEW DG VI TAXIWAY
Intersecting Taxiways	$23,600,000.00	$2,900,000.00
Other	$1,000,000.00	$45,658,000.00
Runway/Parallel Taxiway	$149,620,000.00	$578,400,000.00
Straight Taxiway Sections	$310,320,000.00	$134,325,000.00
TOTAL:	**$484,540,000.00**	**$761,283,000.00**

3. Bridges and Culverts.

This section covers the estimated costs to strengthen the load bearing capacity of bridges and culverts to support the taxiing, landing, and takeoff operational weights of NLA. High construction costs are expected since the width of bridges equals the width of the safety area(s) associated with the runway or/and taxiway. Three basic cases arise. If only a taxiway is involved, then the bridge width equals the width of the taxiway safety area. If only a runway is involved, then the bridge width equals the width of the runway safety area. If a runway and a parallel taxiway are involved, then the bridge width equals the combined full and continuous width of the runway and taxiway safety areas. On the other hand, culvert widths may in a few cases be less than the width of the safety area. The category "Other Costs" includes costs attributed to structural reinforcement, retaining walls, road excavation, electrical systems, and drainage.

a. Tables 9 and 10. Tables 9 and 10 show cost breakdowns by airport alphabetically and according to rank order. Eight airports reported necessary upgrades. Two airports, SEA and ANC, reported the need to upgrade for two of three reporting categories. No airports reported need upgrades for the Runway Only category.

(1) For the runway with parallel taxiway case, seven airports reported costs. Two airports, LAX and DFW, reported upgrade costs for both bridges and culverts of approximately $135 million and $54 million, respectively. Two airports, MIA and SEA, reported costs only for bridges of approximately $47 million and $32 million, respectively. Three airports, STL, IAH, and ANC, reported costs only for culvert upgrades of approximately $3 million, $3 million, and $1.5 million, respectively.

(2) For the taxiway only case, three airports reported estimated costs. JFK reported upgrades to both bridges and culverts at a cost of $25 million. SEA and ANC report costs of $24 million and $1½ million respectively.

(3) For the runway only case, no airports reported costs.

b. Table 11. Table 11 shows the estimated costs by design features. The average cost for taxiway bridges is $24 million and for combination runway and parallel taxiway is $86 million. Culvert upgrades averaged $9 million for taxiways and $13.5 million for combination runway/parallel taxiway.

Table 9. Estimated Cost for Bridges/Culverts by Alphabetical Order.

IDENTIFIER	RANK	COMBINATION RUNWAY WITH PARALLELTAXIWAY	RUNWAY WITHOUT PARALLEL TAXIWAY	TAXIWAY ONLY
ANC	11	$2,000,000.00		$1,500,000.00
ATL	16	$0.00	$0.00	$0.00
BDL	22			
BOS	9			
DEN	19	$0.00		
DFW	18	$53,656,250.00		
DTW	8	$0.00	$0.00	$0.00
IAH	17	$3,000,000.00		
IAD	6			
JFK	2			$25,500,000.00
LAX	1	$335,000,000.00		
MEM	20	$0.00		$0.00
MIA	5	$47,000,000.00		
MSP	10	$0.00		
ORD	7			
PHL	14	$0.00		
PHX	21			
SEA	12	$31,500,000.00		$23,500,000.00
SFO	4			
STL	15	$2,500,000.00		
TOTAL:		**$474,656,250.00**	**$0.00**	**$50,500,000.00**

Table 10. Estimated Cost for Bridges/Culverts by Rank Order.

IDENTIFIER	RANK	COMBINATION RUNWAY WITH PARALLEL TAXIWAY	RUNWAY WITHOUT PARALLEL TAXIWAY	TAXIWAY
LAX	1	$335,000,000.00		
JFK	2			$25,500,000.00
SFO	4			
MIA	5	$47,000,000.00		
IAD	6			
ORD	7			
DTW	8	$0.00	$0.00	$0.00
BOS	9			
MSP	10	$0.00		
ANC	11	$2,000,000.00		$1,500,000.00
SEA	12	$31,500,000.00		$23,500,000.00
PHL	14	$0.00		
STL	15	$2,500,000.00		
ATL	16	$0.00	$0.00	$0.00
IAH	17	$3,000,000.00		
DFW	18	$53,656,250.00		
DEN	19	$0.00		
MEM	20	$0.00		$0.00
PHX	21			
BDL	22			
TOTAL:		**$474,656,250.00**	**$0.00**	**$50,500,000.00**

Table 11. Estimated Costs for Bridges & Culverts.

Runway /Parallel Taxiway

DESIGN FEATURE	Count	Sum	Average
Bridges	4	$344,000,000.00	$86,000,000.00
Culvert(s)	5	$67,656,250.00	$13,531,250.00
Other	2	$63,000,000.00	$31,500,000.00
TOTAL:	**11**	**$474,656,250.00**	

Taxiway Only

DESIGN FEATURE	Count	Sum	Average
Bridges	1	$24,000,000.00	$24,000,000.00
Culvert(s)	3	$26,500,000.00	$8,833,333.33
TOTAL:	**4**	**$50,500,000.00**	

4. Terminal and Apron Environments.

This section covers the reported estimated costs to upgrade terminals and aprons. Reported costs for terminals and aprons were grouped under the category of either a single main international terminal or more than one international terminal. With the exception of SFO, airports reported upgrades under the category Single Main Terminal. Costs are attributed to modification/new passenger lounges, passenger boarding bridges, apron extensions, and aircraft ground service, such as, relocation/new fuel hydrant systems, Customs & Immigration facilities, baggage processing, and the category "Other Costs." Items under the category "Other Costs" include new or relocation of signs, lights, electrical systems, new drainage, etc. Attachment 5 provides cost breakdowns by design features and total estimated costs by individual airports.

a. **Table 12**. Table 12 shows the reported costs alphabetically by airport. Two-thirds of all reported costs were for IAH, LAX, and SEA respectively at $364 million, $176 million, and $116 million. For the remaining 12 airports, the average cost is $28 million. SFO was the only airport reporting upgrade costs under the category "Separate Facility."

b. **Tables 13 and 14**. Table 13 divides costs into eight subgroups. Terminal costs were summed from the four subgroups of passenger loading bridges, gate & holding areas, Customs & Immigration, and baggage processing. Apron costs were summed from the three subgroups of parking strength, apron extension, and aircraft ground services. The category "Other" represents unlisted subgroups. The highest cost items were Customs & Immigration, and gate/holding areas, which represents 40 percent of the total costs. Table 14 assembles the eight subgroups into three cost categories, i.e., Apron, Terminal, and Other. The table clearly shows that the Terminal category represents 74 percent of all costs associated with the category Main International Terminal.

Table 12. Terminal and Apron Improvements.

IDENTIFIER	RANK	MAIN INTERNATIONAL TERMINAL	SEPARATE FACILITY
ANC	11	$9,400,000.00	
ATL	16	$12,400,000.00	
BDL	22		
BOS	9	$27,000,000.00	
DEN	19	$1,800,000.00	
DFW	18		
DTW	8	$0.00	
IAH	17	$364,000,000.00	
IAD	6		
JFK	2		
LAX	1	$175,640,000.00	
MEM	20	$27,000,000.00	
MIA	5	$22,000,000.00	
MSP	10	$30,000,000.00	
ORD	7	$63,750,000.00	
PHL	14	$13,350,000.00	
PHX	21	$28,700,000.00	
SEA	12	$116,000,000.00	
SFO	4		$56,000,000.00
STL	15	$48,500,000.00	
TOTAL:		**$939,540,000.00**	**$56,000,000.00**

Table 13. Improvement Costs Breakdown by Design Features.

DESIGN FEAUTURE	MAIN INTERNATIONAL TERMINAL	SEPERATE FACILITY
Aircraft Ground Service	$26,650,000.00	$94,000,000.00
Apron Extension	$82,540,000.00	
Baggage Processing	$43,450,000.00	
Customs & Immigration	$360,500,000.00	
Gate & Holding Area	$226,800,000.00	
Other	$86,400,000.00	$18,000,000.00
Parking Strength	$51,000,000.00	
Passenger Loading Bridges	$62,200,000.00	

Table 14. Improvement Costs Grouped under Apron, Terminal and Other.

AREA	MAIN INTERNATIONAL TERMINAL	SEPARATE FACILITY
Apron	$160,190,000.00	$94,000,000.00
Other	$86,400,000.00	$18,000,000.00
Terminal	$692,950,000.00	

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